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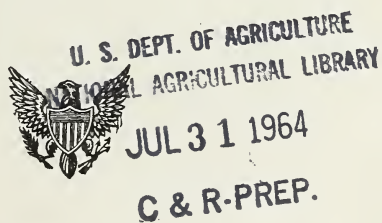
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A REPORT TO CONGRESS "

U.S.
PREPARED BY

THE AGRICULTURAL RESEARCH SERVICE "

OF THE

DEPARTMENT OF AGRICULTURE



PRESENTED BY MR. YOUNG OF NORTH DAKOTA

SEPTEMBER 12, 1963.—Ordered to be printed

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IN THE SENATE OF THE UNITED STATES,
September 12, 1963.

Resolved, That there be printed as a Senate document a report to Congress by the United States Department of Agriculture entitled "Proposed Program for Expanded Research in Food and Nutrition", prepared by the Agricultural Research Service, and that there be printed one thousand additional copies of such document for the use of the Committee on Appropriations.

Attest:

FELTON M. JOHNSTON, *Secretary.*

II

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HIGHLIGHTS

The present scale of USDA research in food and nutrition is inadequate in light of the Department's responsibilities and the Nation's needs. This report proposes an expansion and intensification of this vital scientific effort, including:

Construction of three new regional laboratories for food and nutrition research—in the North Central region, the Southeast, and the Southwest.

Expansion of facilities for nutrition and consumer-use research at the Department's Agricultural Research Center.

Increasing, over a 3-year period, the Department's professional manpower for food and nutrition research from 80 to 148 scientists, and increasing intramural program funds for—

Nutrition research—from \$500,000 to \$1,850,000.

Food science research—from \$1,050,000 to \$2,350,000.

Food consumption research—from \$260,000 to \$1,000,000.

Greatly expanding the Department's extramural research program in food and nutrition through grants and contracts that would increase the present effort from \$120,000 to \$4,000,000.

These proposed increases would boost the scale of the Department's total research effort in food and nutrition from \$1,930,000 to \$9,200,000.

PROPOSED PROGRAM FOR EXPANDING RESEARCH IN FOOD AND NUTRITION

A Report to the Congress of the United States

SUMMARY

The Department of Agriculture and the State agricultural experiment stations were the first scientific organizations in the United States to establish a program of research in food and human nutrition, and to make the results of this work available to the people for better living.

The first appropriation by the Congress to a Federal agency specifically for studies in human nutrition was made to the Department in 1893.

In the 70 years since that time, USDA scientists have been among the outstanding pioneers and world leaders in food and nutrition research. Their findings have helped greatly to improve American diets and have benefited the nutritional well-being of millions in this country and throughout the world.

USDA research has also given farmers, the food industry, educators, and public leaders vital data on food products and consumer needs essential for agriculture and for national and international food programs.

The fact is, however, that knowledge of both foods and human nutrition is still extremely limited. Neither the needs of agriculture nor the needs of consumers are being met.

MORE RESEARCH REQUIRED

In spite of the Nation's food abundance and the increasing use of protective foods, such as meat, milk, eggs, fruits, green and yellow vegetables, our people today are more anxious about proper eating and good nutrition than ever before. The problem of obesity and questions about the place of fats in the diet, for example, are matters of widespread public concern.

Our present inadequate understanding of the role played by fats in the diet is just one indicator of the need for greatly increased knowledge of the foods we eat and how they affect daily living.

Some authorities believe we should eat less fat. Others emphasize paying attention to the kind of fat consumed. The fat problem is only one of many aspects of nutrition that need much further study.

Scientists today are asking whether proper diets can slow down the aging process. Research with experimental animals, carried on through 90 generations, has demonstrated that diet modification could extend the average lifespan substantially. The increase came during the prime of life—with earlier maturity and delayed senility. Can human beings get a similar benefit from improved diets?

To get precise answers to such questions, we must greatly strengthen present research in food and nutrition. We urgently need more exact knowledge of the kinds and amounts of food necessary for optimum growth and health of all our people.

The national interest demands that we discover and understand fully how the food we eat affects health and well-being throughout life.

PROPOSED PROGRAM

This report proposes an expanded program by the Department of Agriculture to help meet national requirements for food and nutrition research during the next 3 years.

The program would—

- Increase USDA scientific manpower in this field from 80 to 148 scientists;

- Increase the Department's program funds from \$1,930,000 to \$9,200,000, including an additional \$4 million for extramural contracts and grants; and

- Provide \$8,920,000 for new USDA research facilities essential for the intramural portion of the total effort.

REGIONAL LABORATORIES

The construction of three new regional laboratories is proposed for research in food and nutrition—one in the north-central region, one in the Southeast, and one in the Southwest—at a cost for all three of \$1,900,000. Each laboratory would have a professional staff of 15 to 20 scientists. About half would be USDA employees and the remainder would be cooperating scientists of the State experiment stations and other institutions. Foods produced in different parts of the country and prepared for eating in the different ways characteristic of each region are known to differ in nutritive values. We are finding also that persons living in different parts of the country may respond differently to quite similar diets.

What do these differences mean for the health of the Nation as a whole? This is one of the questions that scientists in the regional nutrition laboratories would attempt to answer.

RESEARCH CENTER FACILITIES

Nutrition and consumer-use research at the Agricultural Research Center, Beltsville, Md., is now conducted in four different buildings, none of which was designed specifically for the type of work underway. These buildings would not provide space for an expanded program.

The need for a well-equipped new building for this research has been recognized by the Department for many years. Construction of more adequate facilities at Beltsville has been urged both by the National Agricultural Research Advisory Committee and by the Secretary's Committee on Agricultural Science. Cost of the proposed building would be \$7,020,000.

Locating this facility near Washington affords maximum opportunity for cooperation with related physiological, biochemical, and biomedical research of other Federal agencies. No place in the world has more ready access to scientific resources, especially in the life sciences, than does Metropolitan Washington.

AREAS OF WORK

The three main areas of work to be expanded and intensified are nutrition research, food science research, and food consumption research. Increases are proposed both in the intramural program and in the extramural program of contracts and grants in each of these areas.

NUTRITION RESEARCH

The adequacy of a diet was once evaluated largely in terms of the rate of growth achieved by the young. This is still important in feeding farm animals, but to measure the adequacy of a diet for the full lifetime of man we need a longer and better yardstick.

Man's nutritional response to our wide variety of foods will have to be understood more clearly than it is now, if we are to learn what foods in what amounts and combinations will make the greatest nutritional contribution to normally healthy people.

This means we must learn to measure metabolic responses in man, or suitable experimental organisms, to the multiple combinations of available foods and nutrients, in order to discover principles that will lead us to improved human nutrition.

With the superb new research tools now in the hands of biochemists, and with others that can be developed, scientists can discover and explain the mechanisms of human metabolism which dictate our nutritional needs at every age.

We need to know how to use available foods to achieve sustained vigor over a lifetime. We need more information on the nutritional relationships among foods and the physiological processes they support.

Paralleling short-term studies of human metabolic patterns, we need related studies covering the entire lifespan of experimental animals, to determine the long-term effects of varied assortments of nutrients. Animal studies can define the function and interdependence of nutrients in biological processes of growth, reproduction, and aging more fully than can studies with man. They can also determine the proportions among nutrients favorable to sustained biological vigor.

The role of the so-called minor minerals in nutrition requires greater study. Some trace minerals can help protect the body from elements acquired from industrial environments or fallout. Zinc, for example, is protective against its radioactive counterpart, zinc 65, and calcium is protective against strontium 90.

More knowledge in these and other areas is the aim of the proposed program to expand nutrition research from \$530,000 to \$3,050,000.

FOOD SCIENCE RESEARCH

In today's markets consumers find many different kinds and forms of food, and there is every indication that food science and technology will increase this number and variety.

The properties of many staple foods are being changed by processing, which may also change the nutrient content by decreasing or increasing the amounts of protein, fat, carbohydrate, minerals, and vitamins.

Some of these changes are readily recognized by consumers. But others, less obvious, may also detract from or add to the nutritive values the consumers have learned to expect.

The palatability and attractiveness of food as prepared for eating influence the amount and type of food eaten, and thus the nutrient intake of consumers. For this reason USDA conducts research on the physical structure, chemical properties, and biochemical systems of food commodities as they affect qualities important to consumers.

Because food properties are modified by household preparation, Department research also helps establish principles and improved procedures for household use and preservation of foods.

But the present scale of USDA research in food science falls far short of meeting the country's need for better knowledge of the things we eat. It is proposed that this effort be increased from \$1,095,000 to \$4,320,000. Much of the work will explore areas in which scientists have so far hardly ventured.

More complete tables of food composition must be compiled. Existing data are adequate for only a fraction of the nutrients recognized as essential. As a result, estimates of the potential nutritional quality of foods and diets undoubtedly overlook important values in some foods.

Analyses of foods should be made on a multivitamin basis, season by season, as marketed in major geographical consumer areas, and as prepared for eating.

More attention should be given to the chemical forms and complexes in which carbohydrates, fats, proteins, minerals, and vitamins occur in foods.

FOOD CONSUMPTION RESEARCH

Work in this area includes studies of patterns of food consumption and dietary habits of the different groups in our population.

Adequate information about the Nation's dietary situation—what people are eating and why, the nutritive content of their food, what families spend for food, and family food-management practices—is essential for most effective use of foods.

Periodic nationwide surveys of the amounts of various foods consumed by families and individuals are needed as benchmarks and measures of progress relating to food production, distribution, control, and consumption. The data are used by the Congress, the Department of Agriculture and other Federal agencies, the food industries, educators, and other public leaders.

Information from such surveys helps in estimating the effect on diets of changes in food composition. Such changes may result from various causes, including food additives, residues of agricultural chemicals, or radioactive fallout. Surveys also aid in forecasting changes in our national food consumption patterns as our population grows older.

These studies of national food consumption are needed every 8 to 10 years. The latest one was made in the spring of 1955, and another should be started in the fall of 1963.

If the public is to benefit from basic research in food and nutrition, the results must be interpreted to answer the practical problems faced by family food managers, individual consumers, teach-

ers or extension workers, or Government agencies formulating national or international food programs.

Many different combinations of foods can meet the nutritional requirements of normal healthy persons. The kind of diet recommended for the population has immense implications for agriculture.

Research that will lead to a better understanding of why food choices are made, and how food habits can be changed, is needed as background for programs of nutrition education and food distribution, as well as for all efforts to influence people to use new or different foods. This work is interdisciplinary, involving social psychologists, anthropologists, food economists, food technologists, home economists, and nutritionists. Federal support of this type of research has been small. Expansion of this program is essential if the Department is to maintain its leadership in nutrition education programs.

To make the periodic national surveys of food consumption and various smaller special-purpose studies, and to analyze and interpret the results, it is proposed that funds for this work be increased from \$305,000 to \$1,830,000.

CONGRESSIONAL DIRECTIVE

The Senate report on the agricultural appropriations bill for 1963 stated (August 1962):

The committee has given consideration to the long-range needs for an accelerated nutrition and consumer research program and * * * [requests] the Department to make a thorough study of nutritional research programs conducted in the Department in cooperation with the States and by private industry. The committee recommends that after careful evaluation of present work and future requirements the Department submit a report on this which will embody long-range needs projected over a 3-year period development program.

The research program referred to is the food and nutrition portions of the Agricultural Research Service's work on nutrition and consumer-use research. For brevity in this report, the organizational units concerned are referred to as "the Department."

In preparing this report the Department has taken account of the recommendations regarding its program made by many groups: the National Agricultural Research Advisory Committee to the Secretary and its subsidiary Food and Nutrition, Home Economics, and Commodity Research Advisory Committees; oral reports (minutes of meetings) from the Secretary's Committee on Agricultural Science; statements made by the Food and Nutrition Board of the National Academy of Sciences-National Research Council; letters from research directors of food and drug industry organizations, and the testimony of individuals appearing on their own behalf or on behalf of the American Home Economics Association before committees of the Congress. The Department also has considered the work underway in the State agricultural experiment stations and other research institutions.

INTRODUCTION

The U.S. Department of Agriculture has national responsibility for the production of enough food and a proper assortment of foods to meet the needs of the Nation's citizens for a high level of nutritional well-being. To fulfill its mission agriculture must be an authority on its products, and it must disseminate information about the qualities of its products that make them valuable and attractive to the ultimate consumer, and about methods by which these qualities may be conserved or enhanced. Agriculture also must be knowledgeable about human requirements for foods and nutrients and how consumers can use food products to greatest advantage.

To provide the scientific background for this mission, the Department conducts research on human nutrition and the effective household use of food. Stated briefly, this research includes investigations relating to—

- (1) Nutrition: The food and nutrient requirements of persons at different stages and under different conditions of life; the effect of nutrient balance, environmental conditions, and other factors on metabolic processes; and the state of nutrition supported by customary diets;

(2) Food science: The nutritional and other properties of food products that are important to consumers—values inherent in foods and changes, natural and induced, that occur in food between the farm and the table;

(3) Food consumption: Surveys of the kind and quantities of food used by different groups of households and by individuals; appraisal of the nutritional adequacy of diets and food supplies; and development of guidance materials leading to dietary improvement in this country.

The Department's basic and applied research in food and nutrition is consumer oriented, multidisciplinary, and characterized by the overview taken of food as a dynamic force throughout the lives of normal healthy persons.

Legislative authority for this research derives from the general charge of the Congress when the Department was established on May 15, 1862, "to acquire and to diffuse among the people of the United States useful information on subjects connected with agriculture in the most general and comprehensive sense of that word * * *."

This charge became more specific 84 years later in the Research and Marketing Act of 1946. After declaring it to be the policy of the Government "to promote the efficient production and utilization of products of the soil as essential to the health and welfare of our people," the Research and Marketing Act authorized and directed the Secretary of Agriculture "to conduct and to stimulate research into the laws and principles underlying the basic problems of agriculture in its broadest aspects, including but not limited to—

* * * research into the problems of human nutrition and the nutritive value of agricultural commodities, with particular reference to their content of vitamins, minerals, amino and fatty acids, and all other constituents that may be found necessary for the health of the consumer and to the gains or losses in nutritive value that may take place at any stage in their production, distribution, processing, and preparation for use by the consumer * * *.

Including such investigations as have for their purpose * * * the maximum contribution by agriculture to the welfare of the consumer.

Appropriations specifically earmarked for the study of human nutrition by the Department were first made in 1893. Under the leadership of Dr. W. O. Atwater, a program of nutrition investigations was developed, including research into the composition, nutritive value, and relative economy of American food materials; the energy, nitrogen, calcium, phosphorus, and iron requirements of man, and dietary studies among groups of individuals and families to determine the intake of foods and their component nutrients for the support of life and work of people engaged in typical occupations.

From this beginning the present program of the Department has developed. Its research now recognizes the importance of many additional nutrients, encompasses the many new varieties and forms of food available on the market, and continuously evaluates the changes in the conditions of living which have implications for human nutrition and consumer use of food.

NUTRITION

Agricultural products—milk, meat, eggs, grain, fruit, and vegetables—supply some 100 constituents which are involved in the nutrition of people. Much has been learned about the nutritional functions of many of these constituents; their biochemical interactions in metabolism; their potential contributions to the body's needs for food energy and nutrients; and the results of deficiencies, excesses, or imbalances among the nutrients.

Further research is needed to learn more precisely about the effects of different levels of intake of nutrients and of foods on growth, reproduction, longevity; on the composition of blood and tissue, and on the structure and performance of the body at various stages of life.

Discoveries of interrelationships among nutrients in metabolism, such as interactions among fatty acids, vitamins and minerals, or among proteins, minerals, and organic acids, emphasize the need for thinking of food commodities as structured assortments of nutrients in specific proportions. Their nutritional role differs with their amounts in the diet and their combinations with other foods.

Research into the nutritional contributions of various foods will aid not only in defining requirements for foods and nutrients but also in establishing the lower and upper limits of nutrient assortments and of food combinations conducive to the highest level of nutritional well-being.

Some contributions of the Department to knowledge of nutritional requirements and the biological response of man and laboratory animals to diet are given below:

- 1894. Began investigations of human energy expenditures under various conditions of environment and activity, using the Atwater-Rosa respiration calorimeter developed by the Department—the first satisfactory instrument for making such measurements in man.
- 1939. Determined the vitamin A requirements of adults in studies that demonstrated the possibility of obtaining quantitative data for vitamin requirements with human subjects.
- 1947–59. Cooperated with State experiment stations and public health services in assessing the dietary habits and nutritional state of some 12,000 persons in various population groups throughout the United States. Reporting of results has constituted 180 publications.
- 1952. Demonstrated that ad lib consumption of diets with moderate excesses of some nutrients accelerated appearance of degenerative changes in tissues of rats.
- 1953–60. Defined quantities of linoleic acid, a polyunsaturated fatty acid, needed by infants and children (contract research).
- 1955. Developed a standardized reference diet now being used extensively as a research tool in human metabolic studies. (See below—1960, 1962.)
- 1956. Provided the first data on the quantitative requirements of young women for 8 essential amino acids, derived from metabolic studies with more than 50 women (contract research in 3 locations).
- 1960. Reported that the kind of dietary carbohydrate affected bodily use of protein and fat and influenced levels of blood cholesterol in the rat.
- 1960. Reported that the kind of carbohydrate in the media affected the growth and protein synthesis of unicellular organisms.

1960. Published first data on metabolic response of young men to fats containing different levels of linoleic acid incorporated in the 1955 standardized diet. Response was measured by blood levels of cholesterol, fatty acids, and triglycerides; and by intake and outgo of nitrogen, total fat, and three minerals (contract research at three locations).
1961. Demonstrated that hydrogenated fat in the diet of the female rat may accentuate vitamin B₆ deficiency during prenatal development of the young, depending on level of dietary fat and the strain of animal.
1962. Reported differences among strains of rats in their ability to utilize the same diets and to withstand the stresses of nutrient imbalances.
1962. Published data on the metabolic response of 30 young women to the 1955 standardized diet (contract research at 4 locations) that gave insight into the interrelationships of the needs for essential nutrients.
1962. Published a comprehensive analytical summary of metabolic data on magnesium in human nutrition, which included an estimate of magnesium requirements for children, preadolescents, adolescents, young men and women.

CURRENT PROGRAM

The current program in nutrition research is dealing primarily with fat—the effect of the kind and amount of dietary fat and with other factors influencing lipid metabolism in long-term nutrition of laboratory animals and in short-term metabolic studies of man.

Lifespan studies with laboratory animals

The effect of kind and amount of dietary fat on development and maintenance of normal tissue composition and structure during the lifespan of male rats is under study. Results will provide information on levels of lipids (fat and cholesterol) in blood, carcass, and vital organs, and on histological structure of kidney, liver, heart, adrenals, thyroid, and brain.

Just being completed are studies of the lifetime responses of male rats to a series of semipurified diets, when about one-fourth of the diet was replaced with egg, milk, beef, or peanut butter, with amounts of protein and fat from each source approximately equal. Measurements of metabolic response include growth rate, adult weight gain, longevity, kidney and liver composition, and the size, composition, and histological structure of vital organs. Additional research is underway to determine the combinations of nutrients that are associated with such responses.

Short-term studies with humans

In multinutrient studies with preadolescent girls receiving their dietary protein from vegetable sources, data are being obtained on blood lipid levels and fat intake and outgo. This work is cooperative with seven Southern State stations which are obtaining data on two B vitamins, selected amino acids, 8 to 10 minerals, and on nitrogen and energy utilization.

The Department is assembling and publishing the basic data obtained by the cooperators on all nutrients for 35 preadolescent girls

receiving diets differing in amounts of protein, studied in 1954, 1956, 1957, and 1958. In these studies the Department obtained data on fat and on four B vitamins—niacin, folic acid, pantothenic acid, and vitamin B₁₂.

In multinutrient studies of women, measurements are being made of the metabolic response to two monotype diets at low and moderate levels of calorie intake, providing 20 and 30 percent of the calories from fat. Both diets contain abundant amounts of protein, minerals, and vitamins, and the form of the diet is such that the same amounts and proportions of nutrients are consumed at each meal. Criteria of response include changes in blood lipid levels, and in excretions and retentions of selected nutrients—nitrogen, minerals, and vitamins—during 1 or 2 months at each calorie level. Important data on the metabolic patterns and rates of adaptation of individuals of different ages and dietary backgrounds to the same controlled diet are emerging from these studies.

In every nutrition study involving the metabolism of children or adults, biochemical and physical measurements are made to assess the initial state of nutrition as supported by the individual's customary self-chosen diet. The measurements are then repeated periodically during the study to indicate response to the controlled diet and to altered levels of intake. From statistical analyses of such accumulations of data on a number of individuals on self-chosen and standardized diets, it is possible to derive valid interpretations and applications regarding human metabolic processes.

PROJECTED PROGRAM

There is great need for more knowledge about processes in internal metabolism and the mechanisms and controlling factors of nutritional processes, including the interrelationships among nutrients and the effect of other food constituents. Agriculture and the science of nutrition need more information on the range of intakes that are conducive to high levels of nutritional well-being and on the effect of long-term excesses or imbalances in food and nutrient intakes.

1. Food and nutrients for maintaining long-term biological vigor

During the first years of a developmental program, long-term studies with animals would be expanded, using as dietary variables the kind and level of carbohydrate, fat, or minerals as they occur in foods or separated components. Followup studies would determine the components of diet which modify, prevent, or counteract nutritional deficits and excesses and the capacity of the organisms to adapt or recover when a stressful diet is consumed during different stages of life.

Multidisciplinary criteria of response to well-balanced diets, adaptations to long-continued deficits or excesses imposed by dietary imbalances, and study of the sites and biochemical nature of incipient breakdown or tissue aging related to nutrient intake would include: histological examinations of tissues; changes in enzyme systems of tissues and of minerals associated with enzyme and hormonal activity; analyses of amino and fatty acids in blood, liver, kidney, and other

tissues likely to be affected by dietary deficiencies or surpluses; as well as the more usual study of growth rates, longevity, nitrogen retention, and carcass composition at definite ages.

2. *Foods and nutrients in human metabolism*

More studies of human nutrition would be undertaken to extend information on the nutritional status and metabolic response of different age groups to common types of diets at customary levels of intake, and on changes in metabolic patterns resulting from graded levels of intake of selected commodities.

Adolescence is one of the critical age groups for which little information is available on requirements for nutrients or the range of tolerances for specific foods as sources of nutrients; the adult group, 65 years and older, is another. Even for the few age groups that have been more extensively studied as infancy, young adulthood, and the period of pregnancy, there are still too few data to make it possible to predict average requirements and ranges of nutritional adequacy for many nutrients or foods.

(a) During the first years of an accelerated program, data on adolescents would be sought to fill the gap and link with data now being obtained on preadolescents and data already obtained under contract from studies on 60 young men and women over the last 5 years. More criteria for measuring nutritional status and metabolic performances to a reference diet would be obtained than have been possible in the past. The criteria would include intake-output data for nitrogen, fat, and several mineral elements. Data also would be obtained on some 10 amino acids in blood and urine; and in some studies, on levels of selected vitamins such as vitamin B₆, vitamin B₁₂, and other B vitamins in blood and urine.

(b) Analyses of biological materials from all human metabolism studies would include more nutrients. Special attention would be given to so-called minor minerals on which few data are available. It has been demonstrated that animals need copper, cobalt, manganese, zinc, and selenium for normal life processes, and that the zones of tolerance are relatively narrow. It has been shown also that sufficient amounts of some of these minerals stored in tissues or available in current food intake can protect the body from uptake of some undesirable elements which may be ingested adventitiously from food, water, or air affected by industrial environment or fallout. Thus zinc is protective against its radioactive counterpart zinc 65 and calcium is protective against strontium 90. There is particular need to define quantitatively the range between deficiencies and excesses of these elements for man.

Most of the proposed human metabolic studies would be carried out under contract or grant arrangements at locations where facilities, scientific leadership, and volunteer subjects are available and under medical supervision or in close cooperation with medical investigators.

FOOD SCIENCE

Research is needed to characterize, measure, and determine the effect of various factors on the inherent properties of food that make them useful to consumers, in order to understand the relative utility of available products and to suggest how they might be used to yield maximum consumer satisfactions.

Study of the detailed chemistry of foods, the short-term and long-term biological effects of component chemicals, their nutritional values, and the effects on these of preparation and processing (commercial and home) is an area of research especially urged upon the Department by its advisory committees and other outside groups and individuals.

NUTRITIVE VALUES

Knowledge of the kinds and amounts of nutrients provided by different kinds and forms of food is essential to consumer education and many other programs. The Department, since the latter part of the 19th century, has analyzed foods for their content of specific nutrients and has studied the contributions of these to diets as the importance of such nutrients to human nutrition became known.

The nutrient content of a food, chemically determined, indicates its potential nutritive value but does not always indicate adequately the real value to the body of the nutrient from this food source. Differences in availability to the body of nutrients from different food sources have long been recognized. Commercial and household processing as well as the original nature of the food may determine whether the nutrient exists in easily available forms. Early studies noted the effects of some nonnutrient constituents of the diet on the absorption of certain nutrients from any food, such as oxalic acid on calcium and citric acid on iron absorption.

The Department has made many original contributions to knowledge on the biological availability of nutrients from foods. Also it has taken leadership in compiling and publishing tables of food composition based on results of analyses in its own laboratories, the world's scientific literature, and available unpublished data. Some important milestones in this advance are listed below:

- 1895. Published a report on energy value of foods by W. O. Atwater, who had determined the heat of combustion of many foods by the bomb calorimeter, and by making use of digestibility and metabolic studies, had developed a method for estimating the physiological fuel value of foods and diets based on their composition of protein, fat, and carbohydrate.
- 1896. Issued the first comprehensive USDA bulletin on the composition of American foods, a compilation by W. O. Atwater of results of his own and other available analyses.
- 1927. Made the first comprehensive report of quantitative data on vitamin content of foods (vitamins A, B, C, D, and G).
- 1927. Published data on the human utilization of calcium from spinach.
- 1946-51. Reported the extent to which the carotenes of several foods can be used to supply vitamin A needs, and indicated the need for separate figures for carotenes measured chemically and for vitamin A measured biologically.

- 1944-52. Developed microbiological methods for the economical and rapid assay of foods for 10 important amino acids, and published data on their occurrence in important sources of food proteins.
- 1946, 1948. Reported comparative growth-promoting values of the proteins of cereal grains, including data on deterioration of these values during long-term storage, data which are still used as guides to management of stockpiles of grains.
1950. Published new tables of food composition summarizing knowledge of proximate composition, 3 minerals, and 5 vitamins in 750 food items, raw, processed, prepared.
1951. Reported amounts of folic acid—one of the more recently recognized B vitamins—in several hundred foods, based on USDA and other analyses.
1952. Published data on biological availability to man of riboflavin from certain plant foods (contract research).
1956. Compared the utilization of ascorbic acid from 24 foods as served in the customary diets of women with the utilization of the vitamin in crystalline form (contract research).
1956. Published values for pantothenic acid, one of the B vitamins, for about 240 foods, determined by an improved method developed in the Department's laboratories.
1957. Compiled the first USDA tables of amino acids from data obtained in Department laboratories and from the literature, providing average, minimum, and maximum values for 18 amino acids for more than 300 items of foods.
1959. Published the first extensive compilation of existing data on the fatty acids found in animal and plant products.
1959. Reported the content of nine minerals in market samples of vegetables from different production sources.
1961. Published values for the vitamin B₁₂ content of foods, thus adding to the series of laboratory data on the B vitamins.
1961. Published data on the comparative value to man of essential amino acids as present in four foods—egg, milk, peanut butter, and oats—with the same pattern of amino acids fed in crystalline form (contract research).

CURRENT PROGRAM

Despite the impressive contributions of the past, information about the nutritive values of food is still inadequate.

Nearing completion is the first major revision of the general food composition tables issued in 1950, Agriculture Handbook No. 8. The new edition will contain about 2,500 items with former figures on some 13 constituents revised where obsolete and with data on two additional minerals, sodium and potassium, for all items. For many items data on magnesium, selected fatty acids, and cholesterol will also be presented. Thus data are available only for a relatively small number of nutrients on a comprehensive list of foods.

In view of the rapidly increasing number of new forms of food, the inherent nature of which is being modified by science and technology, and in view of the many additional nutrients the significance of which is only now becoming recognized, much more work in this area is obviously needed.

Foods now being analyzed for nutrient content in Department laboratories include a wide range of familiar and new products, as marketed and to some extent, as eaten. All foods are being analyzed for proximate composition, some for mineral elements, some for selected B vitamins, and others for fatty acids. The Department also continues to study the nutritional quality *in vivo* of individual foods. Studies also are in progress to ascertain the relative value of different foods and food combinations used to provide protein, fat, or carbohydrates. Findings from research with laboratory animals or micro-organisms will be confirmed by more limited studies with man.

PROJECTED PROGRAM

To meet the urgent need for more comprehensive information on nutritive values an accelerated and expanded program is projected to include—

- (1) Increased attention to the chemical forms and complexes in which carbohydrates, fats, proteins, minerals, and vitamins occur in foods, and the effect of these on nutritive values. Special attention will be given to nutrients for which data are sparse or nonexistent and that recent research has demonstrated are important to man. Among these nutrients are mineral elements important in biological enzyme systems and in blood formation; carbohydrate forms including starches, pectins, celluloses, and sugars which have been shown to affect lipid metabolism; organic acids which may influence absorption of other nutrients such as the mineral elements; sterols in foods and the tocopherols whose presence in the diet has assumed increased importance with the increased intake of polyunsaturated fatty acids.

- (2) Analyses of foods on a multnutrient basis, season by season, as marketed in major geographical consumer areas and as prepared for eating, to provide both sound average values and information on the variation in nutritive values to be expected. These studies would be conducted with sufficient control of the variables known to affect content of principal nutrients, such as variety, maturity, processing, storage conditions, so that averages in tables can be adjusted as shifts are known to take place in production or marketing practices.

- (3) Development as needed of special methods of analysis for complex and combined foods and for newly recognized forms of nutrients.

- (4) Summarization of data in convenient tabular form as rapidly as quantitative information on the composition and nutritive value of foods becomes available from the Department's laboratories and other sources. This involves reviewing and indexing some 100 periodicals and other published and unpublished sources carrying information on the nutrient content of foods, and when enough suitable data have become available, summarizing them into meaningful classifications. First attention in a developmental period of research would be given to pantothenic acid, vitamin B₆, vitamin B₁₂, vitamin E, magnesium, and other minerals. Revised tables for amino and fatty acids would be prepared when improved data derived from new analytical methods are available. Data on the content of some 15

mineral elements found in market samples of foods would be summarized in convenient-to-use tables.

FOOD PROPERTIES AND CONSUMER USE

Consumers find many different kinds and forms of food in the markets of today, and there is every indication that science and technology will increase this number and variety. Foods now may be purchased fresh, canned, frozen, dehydrated, and dehydrofrozen; partially prepared, partially cooked, fully cooked, and combined with other foods. Fresh meats on the market today tend to be leaner and from younger animals than formerly. Poultry reaches the market at a younger age. Vegetables and fruits are harvested at an earlier stage of maturity. Perishable foods are likely to have been held in chilled or freezer storage to maintain an even market flow of commodities. Grain products appear in many processed forms. The initial properties of many staple foods are being changed by processing—starches may be modified, fat altered, proteins hydrolyzed or denatured.

Commercial production and processing practices affect food flavor, color, texture, or behavior in household use, as well as nutritive value. Research is needed to identify relationships between the physical structure, chemical properties, and biochemical systems of products on the market with those qualities that are important to the ultimate consumer, such as economy of yield, usefulness in food preparation, storability, palatability of the prepared products, and nutritive values.

Because the properties in foods as marketed are modified by household processing and storage, Department research also helps establish principles and improved procedures for household care, preparation, and preservation of foods.

A few examples of accomplishments over the years may be cited:

- 1942-45. Prepared guidance materials for families on conserving food in wartime.
- 1946. Completed research that put home canning on a scientific basis, replacing earlier adaptations of industrial methods with safer and better home canning directions, and enabling families to reduce spoilage and improve flavor and nutritive value of their home-canned products.
- 1944-46. Investigated and recommended methods of preparing and packaging fruits and vegetables for home freezing so as to retain nutritive and eating qualities.
- 1948. Determined effects of various household cooking methods on vitamin and mineral content of 20 commonly used foods.
- 1951. Reported on sensory methods for measuring differences in food quality—a review of literature and proceedings of a conference of research scientists called to consider the problem.
- 1950. Prepared "Family Fare," at the request of the Congress—a booklet which brought under one cover information on nutrition and food management, including modern principles of cookery and recipes. Revised periodically, this publication is widely used, ranking first or second in yearly demand among all USDA publications.

1955. Developed 2 new aids for improving school lunches—a set of 400 recipe cards for quantity food service, and a food buying guide for type A lunches. Economy, clarity of directions, suitability of the recipes for use with school facilities, and acceptance of the food by children were carefully checked before issuance.
1955. Made available the first comprehensive laboratory data on composition and yield from beef carcass to cooked boneless beef.
- 1955–62. Prepared or revised 24 publications for the general public on household selection, care, preparation, and preservation of various foods.
1962. Developed a process for preserving the color of green vegetables during cooking.

CURRENT PROGRAM

Research on consumer aspects of food qualities now in progress in the Department deals with the relation of structure and composition of meats, fruits, and vegetables to eating quality and other properties; the substances in fruits responsible for their color, flavor, and texture; and the effects of the use of agricultural chemicals upon food flavor and texture. A limited program is underway to develop improved methods for household preparation and storage of foods. This extends and updates earlier studies of the effect of length and temperature of heating upon the palatability, physical properties, and yield of cooked poultry, and of several types of retail beef cuts.

Information presently available on the principles of food preparation, selection of quality foods on the market, desirable storage practices, and other related information is being assembled for major groups of foods. This will provide source material to meet the continuous demand within the Department for up-to-date information on use of specific commodities for food distribution and food promotion programs and for the many requests that come from the press, TV, radio, teachers, and other leaders in consumer education programs.

Specialized studies are being made on satisfactory ways to use certain foods in the school lunch and other food distribution programs of the Department. For example, the quality and yield are being determined of cooked products made with dried egg, bulgur wheat, canned meats, and from different types, sizes, and grades of dried fruits.

PROJECTED PROGRAM

To insure the maximum consumer satisfaction from available food in terms of attractiveness, palatability, and economy of preparation, an expanded program is projected to include studies of—

(1) Changes in the structure of food tissues induced by heating and other household preparation and handling procedures, and their relation to palatability and serving qualities.

(2) The chemical form of the components of food which determine the manner in which foods are affected by customary preparation and cooking practices.

(3) The enzyme actions responsible for changes in chemical composition, functional, and eating qualities of foods during household storage and preparation.

(4) The identification of the components of foods responsible for characteristic flavors and determination of the chemical reac-

tions involved in the development of flavors by natural and induced processes.

(5) Determination of factors affecting sensory evaluation of foods, including study of effect upon taste discrimination of the sequence and combination in which foods are tasted, and of age, dietary habits, ethnic background, or physical activity of the individual.

FOOD CONSUMPTION

Adequate information about the Nation's dietary situation—what people are eating and why, the nutritive content of their food, what families spend for food, and about family food management practices—is needed as a basis for effective efforts to help people use foods to meet the goals set by research in the food and nutrition sciences. The programs and policies that are developed by government and private groups to fill the gaps between the current situation and desirable goals require sound, research-based guidance materials.

An expanded research program designed to obtain information on the dietary situation and to develop materials for effecting desirable changes in dietary habits of the population and for making use of nutrition research in government policies and programs has been recommended by many advisory groups.

THE DIETARY SITUATION

Periodic nationwide surveys of the amounts of various foods consumed by families and individuals and appraisal of the nutrient adequacy of the resulting diets are needed as benchmarks and measures of progress in nutrition education and for use in developing other public programs relating to food production, distribution, control, and consumption. The data are used by the Congress, the Department of Agriculture and other Federal agencies, the food industries, educators, and other public leaders.

More specifically, information both on the food used by households in various regional and socioeconomic groups and that consumed by individuals in various age categories provides a basis for estimating the extent to which food supplies meet recommendations for nutritional well-being. Such information improves the focusing of public programs in food and nutrition; the estimating of the effect on diets of changes in food composition such as may result from intentional food additives, residues of agricultural chemicals, or radioactive fallout; and the forecasting of national food consumption patterns with change in age distribution of the population. Such information also is important in departmental decisionmaking and program evaluation relative to food production, distribution, and consumption. For example, preliminary plans for the pilot food stamp program initiated in 1961 were based in large part on findings of dietary levels from the 1955 survey of household food consumption.

In addition to national surveys of food consumption and diet appraisal, small-scale special-purpose surveys are needed to investigate certain problems in greater depth. Some are studies of the diets of special groups; others test the effectiveness of special food distribution, regulatory, or educational programs for improving diets. For example, studies in the 1930's showed the effect of low-priced milk on

diets of low-income families, and of the school lunch program on diets of children.

Dates of the earlier large-scale surveys of the Department follow with some notable results and accomplishments:

- 1890-1914. Made a series of dietary studies under the leadership of W. O. Atwater, at the Connecticut Experiment Station. The resulting basic information on food consumption of groups of individuals and of groups of families led to tentative dietary allowances for food energy and protein.
- 1935-36. Joined with other Federal agencies in a nationwide consumer purchases study. This provided the first comprehensive picture of food consumption and dietary levels of American families and indicated that one-third of the Nation's families had diets rated poor by nutrition standards. The findings added impetus to efforts to enrich flour and bread with iron and three B vitamins, and stimulated more vigorous nutrition education and school lunch programs.
1942. Conducted a wartime national study of food consumption in cooperation with the Bureau of Labor Statistics. Found marked improvements in American family diets in 1942 over 1936, showing the combined effect of increased purchasing power; more careful choice of foods important to good nutrition as a result of the nationwide nutrition campaign; and enrichment of bread and other cereal foods. Despite improvements, however, many family diets still were below recommended allowances for certain of the B vitamins, vitamins A and C, and calcium.
1948. Conducted a dietary survey of a national sample of urban families and a seasonal study in four cities that provided important information on postwar trends in food consumption and dietary levels.
1953. Reported a study of diets of 1,000 homemakers which shed new light on food habits and nutrition implications for this population group.
1955. Took leadership in a national and regional survey of household food consumption and dietary levels which provided information widely used in public and private programs affecting food supply, distribution, and consumption, and in programs to improve food habits. The basic statistics of the 1955 survey (published in 17 volumes) made possible many analytical studies of factors affecting food consumption which have been published in special bulletins and journal articles.

CURRENT PROGRAM

Work related to nationwide surveys of food consumption is at a low level in 1962, but will soon need to be augmented greatly to plan and carry out the next proposed survey. Meanwhile the data from the 1955 study are still being used in various types of analyses both within and without USDA.

Recent small-scale studies are concerned with the effects of USDA food distribution programs on the nutritional quality of diets of needy families. "Before" and "after" surveys were made in two communities where the food stamp pilot program was undertaken in 1961, and a third area is now being studied as the program is expanded. An-

other study just being completed relates to the dietary situation of a group of low-income elderly families living in one city.

Existing data on the quantities of food and the nutritive value of foods eaten by individuals are being compiled, organized by age, occupation, and other categories. The original data on quantities consumed are largely from studies on nutritional status, made cooperatively with State experiment stations.

Each year a review is made of the nutritive value of the Nation's per capita food consumption based on estimates made by the Economic Research Service of the amounts of food disappearing into retail channels. The nutritional calculations show trends in amounts of nutrients available and the contribution of various groups of foods to total supplies of specific nutrients. Data of this type are also useful in international comparisons because they are reasonably comparable with data available for other countries.

PROJECTED PROGRAM

1. Nationwide surveys of food consumption and expenditures are needed every 8 or 10 years. The latest one was made in the spring of 1955, and another should be made in 1964. It should be large enough to provide year-round data for families in different regions, urbanization and income classes. A sample of approximately 12,000 families is recommended for this purpose. Information on diets of individual household members in addition to that on purchases for the household unit would be obtained. This survey would serve many of the needs of other Federal and private groups as well as those of USDA nutritionists, agricultural economists, and marketing specialists. Staff of other Department agencies would participate in the planning and supervision of the survey.

2. Selected small-scale special-purpose surveys would supplement the nationwide surveys. Except during the peakload of the large-scale surveys, two or three smaller surveys would be made every year. Some of these would investigate food consumption and dietary levels of selected population groups in greater depth than is possible in a nationwide study; for example, those that are likely to have poor diets such as teenage girls, families in depressed rural areas, or special ethnic groups.

Other studies would obtain information that is not possible to secure in nationwide surveys; for example, how selected foods are prepared and served in homes, and the kinds and amounts of foods lost and discarded in homes. Still other surveys would be needed for continuous evaluation of special food distribution, regulatory, or educational programs of the Department; for example, variations in the current food stamp plan program, the donated food program, or the school lunch program.

3. Food habits are revealed, to a certain extent, by the nationwide and small-scale surveys of food consumption and by some of the "consumer preference" studies made as an outgrowth of the Department's increased efforts to expand the marketing of agricultural products. However, no interdisciplinary research directed toward the "why" of food preferences as a background for programs of nutrition education is currently underway.

Research on food habits of individuals would be initiated and gradually expanded to provide a body of knowledge on the reasons

for food choices and how food habits might be changed. Initial emphasis would be on making all possible use of data from the nationwide and smaller scale surveys of food consumption. Then new studies that provide for analysis of attitudes, prejudices, and preferences would be made. The research would be interdisciplinary, involving the social psychologist, anthropologist, food economist, food technologist, home economist, and nutritionist.

DIETARY GUIDANCE

If the public is to benefit from basic research in food and nutrition, guidance materials must be developed that interpret results in terms of the practical problems of the family food manager, the individual consumer selecting food, the teacher or extension worker, or the government agency formulating a national or international food program.

Much information from nutrition research is already available that should be evaluated, interpreted, and disseminated for practical application. Through its summarization, evaluation, and synthesis of research, the Department performs a unique function that furthers the practical application of the food and nutrition sciences.

Examples of materials developed for guidance in food selection and in nutrition education programs are given below:

- 1931-33. Developed flexible USDA food plans—first those which provided for an adequate diet at low cost, reflecting problems that families faced in the great drought in the South and in the depression of the early thirties, and later food plans for individuals and family groups at four spending levels.
- 1941. Published the "Basic Seven"—a simple nutrition guide that gained nationwide acceptance.
- 1944. Published "Principles of Nutrition and Nutritive Value of Foods," just 50 years after nutrition research began in the U.S. Department of Agriculture. As a tribute to W. O. Atwater, the publication was given the same title as his Farmers Bulletin, issued in 1901.
- 1952, 1957, 1962. Took leadership with the Department's Inter-agency Committee on Nutrition Education in sponsoring national food and nutrition conferences for leaders in nutrition education. At these conferences progress in nutrition was appraised and plans made for improved programs.
- 1956. Developed a new and simplified dietary guide "Food for Fitness" based on most recent research on food consumption habits, nutritional needs, and nutritive value of foods. In addition to its wide dissemination as a Government publication, this food guide is frequently republished in many textbooks and incorporated in promotional materials of trade groups.
- 1959. Took leadership in preparing the 1959 Yearbook of Agriculture, "Food," which for the first time in 20 years brought together up-to-date comprehensive information on food and nutrition widely used as reference by teachers and writers and as a textbook. Distribution 3 years after issuance totaled approximately 325,000 copies. "Food" has been translated into Spanish for use in Latin America.

CURRENT PROGRAM

Food plans and budgets at different cost levels indicate quantities of different types of foods which together meet nutritional needs of individuals and families. The plans originally developed in the 1930's are revised periodically to keep them in line with new knowledge of nutritional requirements and the nutritive value of foods, and with changing food habits and the relative economy of foods. The cost of the food budgets is kept up to date through regular pricings using the retail food prices collected by the Bureau of Labor Statistics.

A new technical publication explains the development and use of the food plans and the pricing scheme used. This information is of great value to welfare agencies throughout the country as many of them use the low-cost budget as the basis for the food allotments of families requiring public assistance.

A series of popular publications provides practical guidance to help families improve their food management. A new publication, "Food for the Young Couple," was added to the series in 1962.

Specialized application of nutrition knowledge to practical programs of the Department is made as requested. Examples are the provision of the nutritional base for the recently developed World Food Budget—a study of deficits contrasted with our own abundant supplies, and recommendations of the kinds and quantities of foods to include in the Department's publication on "Family Food Stockpile for Survival." Assistance is also given upon request to various other phases of food planning for civil defense programs.

To stimulate State and local programs in nutrition, a bimonthly periodical, Nutrition Committee News, is issued for members of State nutrition committees and other workers in nutrition education. In related activities staff members serve as consultants on nutrition education, participate in planning workshops and periodic conferences in this field, and provide secretariat services for the Interagency Committee on Nutrition Education. This work is done as part of the Secretary of Agriculture's responsibility "for coordinating nutrition services made available by Federal, State, and other agencies," a function which Executive Order 9310 transferred on March 6, 1943, to the U.S. Department of Agriculture from the Office of Defense, Health, and Welfare Services.

PROJECTED PROGRAM

1. Interpretation of research findings and synthesis of new concepts would be greatly expanded to aid application of research findings on human requirements and on the nutritive value and relative economy of different foods to the Nation's many-faceted food problems. Additional food selection guides for general use would be developed to provide nutritionists, home economists, physicians, and public health workers with authoritative information for promoting good nutrition in this country. Some would relate to general nutrition problems such as combating food fads and selecting the desirable amount and kind of fat for daily consumption. Others would deal with nutrition problems of special groups, such as those of teenage girls. To supplement publications, development of materials for use by other media, as radio, television, and motion pictures would be undertaken.

2. Food budgets at different levels of cost would continue to be kept up to date and revised with advancing scientific knowledge and changes in food prices and food habits. Many different combinations of foods can meet the nutritional requirements of normal healthy persons, and the kind of diet recommended for the population has immense implications for agriculture. For example, adequate diets could be suggested that are based almost exclusively on foods of plant origin. On the other hand, wholesome diets can include a generous proportion of livestock products. Agriculture must be in a position to recommend diets that will promote the highest possible level of health and longevity. Agriculture is also concerned that this be accomplished through a combination of agricultural enterprises that will make excellent use of the Nation's natural resources.

3. The nutrition background for Department policies and programs—in civil defense planning, in special food distribution programs, in foreign aid, and in long-range projections of the demand for agricultural products—would be strengthened through the addition of staff with broad qualifications and experience in nutrition. Provision would also be made for cooperation in international programs concerned with food and better nutrition, such as the Food and Agriculture Organization of the United Nations and food for peace. Liaison would be expanded with other Federal agencies conducting nutrition programs, with State nutrition committees, and with industry. All of these activities are needed to coordinate nutrition activities and to help apply research findings to practical food programs.

PROGRAM AND FACILITY DEVELOPMENT

PROGRAM

The consumer-oriented food and nutrition research of the Department advances scientific knowledge that is needed for intelligent and effective use of food for consumer well-being and satisfaction. It also provides information on consumer practices and viewpoints that agriculture and the food industries should take into account in programming production, processing, and marketing of food products in the public interest.

This research in food and nutrition is shared by State agricultural experiment stations and other organizations, including industry. According to a recent estimate, the Department was doing only about one-fifth of this country's consumer-oriented food and nutrition research. The State experiment stations were doing about one-third, and other organizations including industry, a little less than one-half. Unfortunately, the collective effort falls far short of meeting the needs of consumers, public leaders, and the Government.

Over the years there has been general agreement among advisory committees that the Department has unique responsibilities and qualifications for the kind of research program it has been developing, and that this work should be accelerated, expanded in scope, and increased in depth. Both basic and applied research is needed to serve government and consumers of agricultural products on a nationwide basis. Certain phases of research will be done only if Federal agencies take responsibility. For example, periodic national surveys of food

consumption and dietary adequacy require extensive sampling, simultaneous collection of data from many locations by uniform methods, and a concentration of specialized staff for prompt evaluation of the data. A study having these requirements is not of primary interest to nor feasible for experiment stations or universities to undertake.

Some phases of basic research also gain from the leadership that a strong central program can give to coordination of objectives and procedures. This is done by developing methodology, conducting pilot projects, and by arranging for support of such research through grants, contracts, or cooperative agreements. The Department has given and can give such leadership to studies of the metabolism of normal healthy persons and to studies of the nutritive values or other qualities of food important to consumers. In these circumstances important amounts of data can be collected in a short time, and because they are obtained by comparable procedures, the results can be combined for interpretation and application.

The nature of the Department's current and proposed program in the areas of nutrition, food science, and food consumption has been described in earlier sections of this report.

PROGRAM SUPPORT

To carry out the expanded program proposed over the 3-year development period would require increase in Federal employment from 80 to 148 man-years of professional staff in Department facilities, headquarters and regional. These would be distributed among the areas as follows:

Research area	Professional man-years	
	1963 ¹	Year 3 ²
Nutrition.....	22	53
Food science.....	47	67
Food consumption.....	11	28
Total.....	80	148

¹ At \$25,000 per man-year at October 1962 costs. This support is inadequate.

² At \$35,000 per man-year. This support is modest for year 3.

The funds available for food and nutrition research in 1963 and those proposed for year 1, 2, and 3 for both program and construction are shown in table 1. The intramural program in the area of nutrition would be increased from the present level of \$500,000 to \$1,850,000 by year 3; food science from \$1,050,000 to \$2,350,000; and food consumption from \$260,000 to \$1 million. The overall increase for the total intramural program would be approximately threefold from \$1,810,000 to \$5,200,000.

As resources increase in the years ahead, an increasing proportion of work would be done extramurally through grants, contracts, or cooperative agreements by qualified research institutions. The proposed expansion in the extramural program is from \$120,000 to \$4 million and is also shown in table 1. This over 30-fold increase includes for nutrition an increase from the present level of \$30,000 to \$1,200,000 in year 3; for food science from \$45,000 to \$1,970,000;

and for food consumption from \$45,000 to \$830,000. Extramural work done at universities affords special opportunities to support basic research, to assist in the training of research scientists, and to enlist the interest of scientific leadership the country over.

Every agency undertaking food and nutrition research has a responsibility for increasing knowledge about the nature or behavior of biological materials and processes, and the Department expects that at least half of its future intramural research in food and nutrition will be directed into basic research.

TABLE 1.—*Funds available for food and nutrition research, 1963, and proposed for 3-year development program*

[In thousands of dollars]

Item	Fiscal year 1963			Year 1			Year 2			Year 3		
	Intra-mural	Extra-mural	Total	Intra-mural	Extra-mural	Total	Intra-mural	Extra-mural	Total	Intra-mural	Extra-mural	Total
Program:												
Nutrition.....	500	30	530	750	80	830	1,270	400	1,670	1,850	1,200	3,050
Food science.....	1,050	45	1,095	1,330	410	1,740	1,820	900	2,720	2,350	1,970	4,320
Food consumption.....	260	45	305	650	780	1,430	780	780	1,560	1,000	830	1,830
Total.....	1,810	120	1,930	2,730	1,270	4,000	3,870	2,080	5,950	5,200	4,000	9,200
Construction:												
Headquarters.....						420			6,600			
Regional laboratory.....						1,900						
Total.....						2,320			6,600			
Grand total.....	1,810	120	1,930	2,730	1,270	6,320	3,870	2,080	12,550	5,200	4,000	9,200

FACILITIES

Improved and expanded facilities for nutrition and consumer-use research are imperative both at headquarters and at regional locations.

HEADQUARTERS—METROPOLITAN WASHINGTON

Space for nutrition and consumer-use research at headquarters is now located in four buildings at the Agricultural Research Center and in the South Building of Agriculture. None of these was designed specifically for the type of research underway. The need for a well-equipped central building for this research has been recognized by the Department for many years, and the immediate construction of adequate facilities has been urged both by the National Agricultural Research Advisory Committee and by the Committee on Agricultural Science. The latter Committee recommended that funds be included in the 1964 budget for planning a new nutrition research facility.

A new facility would promote efficient expanded work by providing needed specialized laboratories, including better facilities for studies with human subjects and with experimental animals, more satisfactory arrangements for electronic apparatus, more temperature-humidity controlled rooms needed for many research operations, and more adequate offices.

Metropolitan Washington is an ideal location for a headquarters building for nutrition research because it affords maximum opportunities for intradepartmental and interdepartmental cooperation

with related research of other agencies, and unparalleled access to library resources relating to the life sciences.

Research on food consumption of households and individuals also calls for continuing cooperation with other agencies within the Department and other parts of the Federal Government. Historically, the national surveys have been conducted in cooperation with, or in coordination with, the work of agricultural economists in the Department and the Bureau of Labor Statistics.

Furthermore, USDA headquarters for nutrition and consumer-use research located at the seat of the Federal Government would be advantageous in relation to visits, sponsored by U.S. bilateral and U.N. multilateral programs, of persons from governments around the globe who are establishing research services within their departments or ministries of agriculture. By the location and support given to nutrition and consumer-use research the United States can demonstrate how this work can and should be integrated with food and agriculture programs for the benefit of the entire Nation.

For planning the construction of a central building to house nutrition and consumer-use research at the Agricultural Research Center, \$420,000 is included in year 1. For constructing the building with necessary built-in facilities, \$6,600,000 is included in year 2. The building to be planned would provide about 134,000 net square feet and would release space for other urgently needed work both at Beltsville, Md., and in Washington, D.C. It would house not only the research in food and human nutrition but also the small consumer-oriented research program in clothing, housing, and management of household resources, and would provide space for an in-house program about twice the size of that conducted at present. At mid-1962 costs this headquarters facility would make possible a research program in food and nutrition of about \$3.5 to \$4 million annually.

REGIONAL LABORATORIES FOR RESEARCH IN FOOD AND NUTRITION

Regional laboratories in addition to the facilities at headquarters are needed for the specialized study of food and nutrition that should be done on a regional basis as part of the national program of agriculture. There are not enough existing facilities for research in food and nutrition of both the scope and the depth to best serve agriculture and the consumers of agricultural products.

Research in these regional laboratories would be directed especially toward advancing scientific knowledge about (1) the relation of environmental factors such as climate, food supply, food practices, regional economy, and culture to the nutriture and metabolic patterns of selected age groups in the population in these regions, and (2) the differences in nutritive values of foods produced in different parts of the country and prepared for eating in the manner characteristic of the region. It is not known to what extent observed differences in metabolic response of persons to the same diet are the result of inborn metabolic capacities, or of adaptation to longstanding food habits, or of other environmental factors.

Regional laboratories would make possible coordinated comparative studies of the metabolic response to the same diet by persons of different ethnic origins under customary living conditions in different parts of this country. Through cooperative or contract arrangements,

comparative studies of persons in continental United States could be extended to Hawaii, Alaska, and perhaps to the Commonwealth of Puerto Rico. Through Public Law 480 funds, similar studies of metabolic response to a reference diet would be measured under the environmental conditions and long-term dietary backgrounds of citizens of other nations living in their usual mode of life.

The nutritional values of the agricultural products characteristic of the region and in their native and processed forms would be studied to determine their potential contribution to diets typical of the region.

The proposed regional laboratories for food and nutrition would be located on or near campuses of universities so that the Federal staff would be part of the universities' scientific community. Cooperative or related work making use of contract or grant funds could be located in the same buildings or nearby, contributing to the training of graduate students for research and making use of the university's scientific talent for supervision of research and for stimulation of ideas that sparks creativity.

Funds are requested for the construction of three regional laboratories in year 1 of a development period to conduct and promote cooperative work with States and regions on problems of human nutrition related to environment. One laboratory would be located in the north-central area; one in the Southeast; and one in the Southwest. It is estimated that the construction and equipment of these three laboratories would require \$1,900,000 (at mid-1962 cost levels), \$1,500,000 for construction, and \$400,000 for installed equipment. These regional facilities would make possible a research program in food and nutrition of about \$1.5 to \$2 million annually, part of which amount is included in the projected program for year 2 and the full amount in year 3.





